

Maine Aquaculture Occupational Standards for Marine Finfish Farms

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Standards produced by:



In partnership with:



INTRODUCTION

The Maine Aquaculture Occupational Standards specify the current workforce skills and training needs of Maine's aquaculture industry. They are intended to: (1) give education and training providers a clear and comprehensive understanding of the specific technical skills and knowledge that are critical for the most common careers in each sector; (2) standardize workforce training in the state; and (3) establish an industry-led process to align training with workforce needs as the industry and workforce needs evolve. They are based on direct industry input through extensive one-on-one interviews with commercial businesses across Maine.

This document, produced by the Maine Aquaculture Association (MAA), is specific to the workforce needs at marine finfish farms. Occupational standards for marine shellfish and sea vegetable farms, land-based recirculating aquaculture systems (RAS), and land-based shellfish hatcheries are available at <https://maineaqua.org/education/>.

The project team will update the occupational standards (OS) regularly to remain current with the ever-changing workforce needs of Maine's rapidly evolving aquaculture sector.

BACKGROUND

In 2020, The Gulf of Maine Research Institute (GMRI) and the Maine Aquaculture Association (MAA), in partnership with Educate Maine, and sponsored by FocusMaine, published the Maine Aquaculture Workforce Development Strategy – an in-depth analysis informed by direct input from Maine's aquaculture sector that documents the current and future labor needs of Maine's growing and developing aquaculture industry, and charts a course for Maine to establish a comprehensive workforce training system.

Occupational Standards to inform and standardize aquaculture workforce training are a pillar of the recommendations from the Maine Aquaculture Workforce Development Strategy.

To implement this recommendation, the Maine Aquaculture Association (MAA), which has over a 25-year track record of developing operating standards and best management practices (BMPs) for the Maine aquaculture sector, has worked with GMRI and Educate Maine to develop occupational standards that represent the needs of the sector, and are consistent with state educational standards.

MAA and GMRI built on top of the findings of the Maine Aquaculture Workforce Development Strategy by conducting a new series of interviews with a variety of commercial aquaculture producers and educational institutions to form the standards. The draft standards were then shared with the Maine aquaculture sector and educational community for final review and edits.

The occupational standards are segmented into several sections based on the sector, type of work, and job title, as outlined in the table of contents.

For questions, please contact Christian Brayden, Project Manager at the Maine Aquaculture Association, at christian@maineaqua.org.

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Marine Standard

FINFISH FARM – SALTWATER MARINE TECHNICIAN

This standard is intended to capture the core duties and skills involved in the operation of a finfish farm at the entry-level position. A saltwater marine technician will carry out the day-to-day operations of marine finfish aquaculture, including traveling to and from the site, feeding the fish, monitoring their health, ensuring equipment is in good condition, and helping other crews in feed delivery, fish treatment, and harvest.

DUTIES

VESSEL AND VEHICLE OPERATION

Required:

1. Safely work on a skiff or larger vessel, floating raft, net pen, dock, and shoreside facility with relevant health and safety requirements, including in winter conditions
2. Frequently operate a skiff, following all safety and navigation regulations
3. Operate a lobster style 35-40 ft. boat
4. Dock boats anywhere from a dozen to 30 times per day, in all conditions and tides
5. Keep net out of the prop when departing from net pens

Potential:

1. Trouble shoot common problems that prevent an outboard engine from starting
2. Drive a pickup truck with a trailer, including backing up

FINFISH CULTURE

Required:

1. Monitor and operate the feeding system, including observing fish feeding to ensure feed waste is minimized by proper feeding techniques
2. Observe and record as required - fish growth, feeding rates, signs of illness, mortality, and report any concerns to lead hand
3. Support installation of site grid and fish pens, predator nets; general site maintenance at direction of Lead hand.
4. Clean nets, change nets, and remove biofouling from gear via pressure washing or net cleaning robots, under supervision of lead hand
5. Ensure nets, pens, gear, and overall site remain in good condition, including small repairs, maintenance, and strong knots, as instructed by lead hand
6. Stock juvenile fish in net pens, using a transfer hose, under guidance of lead hand
7. Measure fish weight with fish health team and lead hand/site manager
8. Use a cork line to pull in fish for treatment
9. Help to treat fish under guidance of the fish health team and lead hand/site manager
10. Transfer fish between pens with all safety and legal regulations followed under guidance of lead hand
11. Remove deceased fish from pens

12. Harvest fish from pens onto a harvest barge with all safety and legal regulations followed under guidance of lead hand
13. Report maintenance and repairs, gear inventory, and issues to be resolved to lead hand
14. Work cooperatively with fellow site workers and ensure worker safety is protected at all times; notify lead hand or site manager if safety issues arise.

Potential:

1. Ensure all components of the site Containment Management System (CMS) are implemented effectively, following directions from lead hand. Report deviations from the CMS immediately to the lead hand or site manager.
2. Ensure predator deterrence plans are implemented effectively and in compliance with all relevant laws and regulations, according to direction of lead hand
3. Monitor and record key environmental parameters as necessary (e.g. calibrate and run o2 meter), feed amount of each day, and any other activities, and report to lead hand or site manager
4. Monitor fish health, parasite loads and fish condition. Notify lead hand or site manager if fish health and welfare appear to be compromised.

KNOWLEDGE AND UNDERSTANDING

VESSEL AND WORKPLACE SAFETY

Required:

1. Follow protocol for safely working on the water (vessels of various sizes, dock, etc.) e.g. wet surfaces, lines underfoot, uneven footing, limited space, keep everything tidy on board
2. Boarding, deboarding, and working on large vessels and fish pens
3. Basic navigation and boat handling skills
4. Docking boats of various sizes (skiffs, lobster boats 35-40 ft.) in all tides and conditions
5. Basic nautical knot tying
 - a. Bowline, clove hitch, rolling hitch, pig knot, barrel knot, 3 strand splice
6. The proper form to lift heavy objects. This includes other labor-intensive practices such as shoveling and moving gear/product from vessel to dock/raft and vice versa
7. How to wear or use safety equipment, in compliance with Coast Guard requirements

Suggested:

1. How to appropriately dress and protect yourself in all seasons and weather conditions
2. How to read tide charts and weather reports
3. How to anticipate and prevent dangerous situations on the water

FINFISH CULTURE

Required:

1. The importance of following specified schedules for maintaining gear and the health of the fish, including a basic understanding of site operation and performance principles
2. The characteristics and behavior of healthy fish and the warning signs of disease and illness
3. Level of care to be taken with fish in different life stages i.e. yearlings vs market size fish
4. How care and handling of fish affects their mortality rate, stress levels, and quality in relation to customer preferences

Suggested:

1. Recognition of environmental changes near the farm
2. Basic understanding of fish biology, physiology, and behavior
3. Differences between fish sizes and life stages e.g. smolt versus market size fish
4. Computer skills for automated feeding e.g. enter the number of fish into the feed program

FOOD SAFETY AND REGULATORY COMPLIANCE

Required:

1. The relevant health, safety, and biosecurity requirement associated with handling and transporting fish for human consumption

ESSENTIAL EMPLOYMENT SKILLS

Required:

1. Timeliness and consistency – understanding the importance of showing up for work when scheduled, and on time, working a full shift without major interruptions, and how that can affect the time-sensitive processes of farming
2. How to listen to instructions and carry out tasks as directed, including speaking up if instructions are not understood
3. How to effectively communicate issues and concerns to lead hand and manager, including the admission of mistakes
4. How to professionally engage with others on the water and riparian landowners – be a good neighbor
5. How to work well as part of a team, previous crew-based work is helpful
6. Problem solving

Suggested:

1. How to maintain records via hand-written diagrams/charts or computer spreadsheets, and keep a time log
2. Basic math and writing skills, applied in a farming context e.g. fish per net pen

SEAWEED SUPPLEMENT

DUTIES

1. Rigging seaweed grow lines under direction from lead hand
2. Safely seed lines following protocol put forth by employer
3. Check on seaweed growth and record growth
4. Harvest and handle seaweed, following all necessary health and safety requirements
5. Transport seaweed, following all necessary health and safety requirements

KNOWLEDGE AND UNDERSTANDING

1. The characteristics of healthy seaweed growth and excessive biofouling
2. How to safely use, store, and sterilize a knife while harvesting seaweed
3. Basic biology and interest in seaweed, and knowledge of the marine environment

FINFISH FARM – DECK HAND

This standard is intended to capture the core duties and skills involved in the operation of a finfish farm one step beyond the entry-level position. A deck hand is often a saltwater marine technician who has been promoted, or someone with other aquaculture experience. Their role includes working on a service boat and being a part of larger operations, such as loading and unloading with a crane, delivering feed, and leading lice treatments.

DUTIES

VESSEL AND VEHICLE OPERATION

Required:

1. Safely work on a large vessel (40 to 72 ft.), or smaller vessels as well, including skiffs, and equipment such as a floating raft, net pen, dock, and shoreside facility following relevant health and safety requirements, including in winter conditions
2. Operate and dock a vessel in a wide range of tide and current conditions
3. Operate a service boat crane
4. Provide hand signaling for crane loading and unloading
5. Work with service boat captain to safely operate the boat and complete tasks
6. Coordinate logistics with captain and site manager
7. Work cooperatively with fellow site workers and ensure worker safety is protected at all times. Notify lead hand or site manager if safety issues arise.

Potential:

1. Safely operate a large vessel (40 to 72 ft.) and navigate the farm and surrounding waters in accordance with all rules and regulations
2. Drive a pickup truck with a trailer, including backing up

FINFISH CULTURE

Required:

1. Load smolts on boat and read and monitor oxygen in hold to stock fish, including delivery of transfer hose to saltwater technician
2. Treat fish for sea lice on service boat, including observing health and behavior throughout this process
3. Prepare new nets for installation and aid saltwater technicians in completing the installation
4. Operate seine for fish harvest

Potential:

1. Ensure all components of the site Containment Management System (CMS) are implemented effectively, following directions from lead hand. Report deviations from the CMS immediately to the lead hand or site manager.
2. Ensure predator deterrence plans are implemented effectively and in compliance with all relevant laws and regulations, according to direction of lead hand
3. Monitor and record key environmental parameters as necessary, reporting any deviations from the norm to lead hand and site manager
4. Monitor fish health, parasite loads, and fish condition. Notify lead hand or site manager if fish health and welfare appear to be compromised.

SITE OPERATION

Required:

1. Deliver fish feed to feed barge and appropriate sites, including directing the order of feed silos to be filled
2. Inspect grid lines, including inspecting and repairing shackles, after harvest
3. Report maintenance and repairs, gear inventory, and issues to be resolved to lead hand
4. Work with divers to inspect mooring and repair and replace when necessary
5. Support installation of site grid and fish pens; general site maintenance at direction of lead hand
6. Ensure nets, pens, gear, and overall site remain in good condition, including small repairs, maintenance, and strong knots, as instructed by lead hand

KNOWLEDGE AND UNDERSTANDING

VESSEL AND WORKPLACE SAFETY

Required:

1. Follow protocol for safely working on the water (vessels of various sizes, dock, etc.) e.g. wet surfaces, lines underfoot, uneven footing, limited space, keep things tidy on board
2. Boarding, debarking, and working on large vessels and fish pens
3. Crane operation and signaling
4. Basic nautical knot tying
 - a. Bowline, clove hitch, rolling hitch, pig knot, barrel knot, 3 strand splice
5. How to load and unload feed
6. How to use hose, pump, and hold to transfer, hold, and work with fish in good health
7. The proper form to lift heavy objects. This includes other labor-intensive practices such as shoveling and moving gear/product from vessel to dock/raft and vice versa
8. How to wear or use safety equipment, in compliance with Coast Guard requirements

Suggested:

1. Basic navigation and boat handling skills
2. How to appropriately dress and protect yourself in all seasons and weather conditions
3. How to read tide charts and weather reports
4. How to anticipate and prevent dangerous situations on the water
5. 100-ton captain's license course

FINFISH CULTURE

Required:

1. The importance of following specified schedules for maintaining gear and the health of the fish, including a basic understanding of site operation and performance principles
2. The characteristics and behavior of healthy fish – basic fish biology – more needed than for saltwater technician
3. Level of care to be taken with fish in different life stages e.g. yearlings vs market size fish, and during different events e.g. transfer, treatment, and measurement
4. How care and handling of fish affects their mortality rate, stress levels, and quality in relation to customer preferences

Suggested:

1. Recognition of environmental changes near the farm
2. Basic understanding of fish physiology and behavior
3. Relevant coursework or experience

SITE OPERATION

Required:

1. How to follow orders from captain, site manager, and feed barge
2. Identify signs of wear and tear on equipment, including shackles and moorings
3. How to work with a diver while they are underwater
4. How to prepare and change nets

FOOD SAFETY AND REGULATORY COMPLIANCE

Required:

1. The relevant health, safety, and biosecurity requirement associated with handling and transporting fish for human consumption

ESSENTIAL EMPLOYMENT SKILLS

Required:

1. Timeliness and consistency – understanding the importance of showing up for work when scheduled, and on time, working a full shift without interruption, and how that can affect the time-sensitive processes of farming
2. How to listen to instructions and carry out tasks as directed, including speaking up if instructions are not understood
3. How to effectively communicate issues and concerns to lead hand and manager, including the admission of mistakes
4. How to professionally engage with others on the water and riparian landowners – be a good neighbor
5. How to work well as part of a team, previous crew-based work is helpful
6. Problem solving

Suggested:

1. How to maintain records via hand-written diagrams/charts or computer spreadsheets, and keep a time log
2. Basic math and writing skills, applied in a farming context e.g. fish per net pen

SEAWEED SUPPLEMENT

DUTIES

1. Rigging seaweed grow lines under direction from lead hand
2. Safely seed lines following protocol put forth by employer
3. Check on seaweed growth and record growth
4. Harvest and handle seaweed, following all necessary health and safety requirements
5. Transport seaweed, following all necessary health and safety requirements

KNOWLEDGE AND UNDERSTANDING

1. The characteristics of healthy seaweed growth and excessive biofouling
2. How to safely use, store, and sterilize a knife while harvesting seaweed
3. Basic biology and interest in seaweed, and knowledge of the marine environment

FINFISH FARM – LEAD HAND

This occupational standard builds on top of the duties, knowledge, and understanding associated with the occupational standard for a marine finfish farm saltwater technician as well as that of a deck hand. It is expected that a lead hand will possess the mastery of the expectations of a saltwater technician and a deck hand, including the ability to teach and monitor these duties, the knowledge, and the understanding. The lead hand may run sites for one or more days per week, especially on the weekend. They may be former saltwater technicians or deck hands, or others who also have extensive experience. Lead hands will work closely with, and be relied upon by, site managers.

DUTIES

VESSEL AND VEHICLE OPERATION

Required:

1. Operate larger vessels (up to 50 feet) in tight spaces and in accordance with all rules and regulations
2. Operate, troubleshoot, and make small repairs to a vessel, its motor, and to other tools and equipment (e.g. hose clamp, saltwater pump, change spark plug, flooded motor, kill switch)
3. Dock and undock vessel in a variety of situations e.g. net pen, dock, other vessel all while anticipating tides and currents
4. Basic cell phone communication skills
5. Demonstrate safety in all tasks to be accomplished

FINFISH CULTURE

Required:

1. Oversee and lead day-to-day activities e.g. feedings, wellness checks, and equipment checks
2. Organize and lead larger actions – stocking, transferring, net changes, treatment, and harvest

TEAM MANAGEMENT

Required:

1. Manage teams of workers (5 to 15 people) to implement plans from the manager to ensure safe, efficient completion of a series of tasks
2. Manage these teams of workers while other larger tasks, such as mooring dives, cage checks, lice treatments, etc. are underway
3. Lend workers to other tasks to ensure their efficient, safe completion
4. Resolve conflicts between workers, and effectively communicate up and down the chain of command
5. Operate with direction from, but independently of, the manager, to lead your crew, especially when the manager is not on site i.e. weekends
6. Task delegation, including identifying efficiencies
7. Ensure compliance with all company protocols (SOPs)
8. Monitor and ensure the safety of all site workers at all times.

Potential:

1. Report notable performance, reliability, and leadership potential of employees
2. Set a good example by behaving professionally
3. Provide a continuous improvement mindset

OPERATIONS MANAGEMENT

Required:

1. Track fish inventory, feeding, growth, and mortality, and share with manager for further analysis, including any notes from farm hands
2. Operate, troubleshoot, and make small repairs to machinery, as mentioned above
3. Direct and oversee inspections, maintenance, and repairs of gear
4. Coordinate logistics for day-to-day activities and larger activities on the farm
5. Schedule activities so that sufficient hands are on deck for tasks to be completed properly
6. Solve problems, troubleshoot, and find solutions, and communicate them while out on the farm
7. Take decisive actions based on tides, weather, fish behavior, and harvest goals

FOOD SAFETY & REGULATORY COMPLIANCE

Required:

1. Ensure compliance with all applicable rules and regulations, including HACCP, Coast Guard, and OSHA

Potential:

1. Observe water quality conditions and product quality for disease and product quality management, as relayed by saltwater technicians or fish health team. This may include recording temperature, or providing other related lab and research work.

KNOWLEDGE AND UNDERSTANDING

VESSEL & WORKPLACE SAFETY

Required:

1. How to read weather forecasts and nautical charts
2. Basic communication with other boaters and between teams and other vessels on the farm
3. How to act when Coast Guard boards vessel
4. Team communication via cell phone
5. Knowledge of basic radio communication methods
6. How to demonstrate safe on the water practices

Suggested:

1. First-aid, preferably certified. If not, this will be supplied

FINFISH CULTURE

Required:

1. How to lead a team to stock, transfer, and harvest fish when instructed by manager, and ensure healthy growth and low mortality rates
2. Fish life cycle, healthy growth, and feeding levels
3. Identifying areas to be improved and efficiencies that can be attained

Suggested:

1. SCUBA
2. Relevant coursework or experience

TEAM MANAGEMENT

Required:

1. Human resources management, including interpersonal conflict resolution
2. How to manage multiple teams working concurrently
3. How to delegate workers to concurrent tasks

Suggested:

1. How to foster an environment where farm crew feels comfortable to relay issues and mistakes to you

OPERATIONS MANAGEMENT

Required:

1. How to transfer and potentially input digital records of farm production, expenses, and regulatory compliance
2. Basic production calculations (fish per pen, time to harvest, feed per fish, etc.)
3. How to schedule multiple operations of several scales concurrently e.g. fish feeding and net changes

Suggested:

1. Identifying areas of to be improved and efficiencies that can be attained

FOOD SAFETY & REGULATORY COMPLIANCE

Required:

1. All relevant rules and regulations, including food safety, compliance with on-the-water production and safety practices, and company practices and protocols

SEAWEED SUPPLEMENT

DUTIES

1. Organize the layout and employment of moorings and seaweed grow lines, including floats, droppers, buoys, lines set up to prevent tangling, and proper marking of site
2. Ensure the uniform distribution of the farm layout and seeding of lines to prevent entanglement
3. Direct a team, often in tandem with two boats, to lift the seaweed grow line and harvest the product
4. Safely direct all team members
5. Ensure strict adherence to all worker safety and food safety measures and regulations

KNOWLEDGE AND UNDERSTANDING

1. Knowledge of seaweed growing standards, and noting deviations from projections
2. Identification, and communicating the identification, of poor-quality product (rotten, over-fouled, etc.), biofouling, invasive species, and red tide

FINFISH FARM - MANAGER

This occupational standard builds on top of the duties, knowledge, and understanding associated with the occupational standard for a marine finfish saltwater technician, deck hand, and lead hand. It is expected that a manager will possess mastery of all expectations of a farm saltwater technician, deck hand, and lead hand, including the ability to explain, train, and monitor those duties, the knowledge, and the understanding. The manager must be able to manage multiple teams and ensure the proper organization of the business.

DUTIES

FINFISH CULTURE

Required:

1. Lead larger activities e.g. stocking, transfer, feed delivery, treatment, harvest

Potential:

1. SCUBA diving, or working with divers

OPERATIONS MANAGEMENT

Required:

1. Coordinate shore side preparation activities
2. Track expenses and provide basic budgets for activities and equipment
3. Track product and inventory
4. Track fish growth and lice counts
5. Calculate food conversion ratios
6. Manage and plan the operations of the business, including developing a plan for the day and week regarding feeding of fish, harvest, transfer, gear maintenance, etc.
7. Delegate plan(s) to lead hand(s)
8. Ensure that protocols (SOPs) are followed for stocking, transfer, and harvest, including paperwork and records
9. Analyze fish inventory and growth, compare it to projections to ensure consistent product supply
10. Consolidate feedback from lead hands to create appropriate work plans
11. Distribute work plans for lead hands, and approve work plans for work crews
12. Organize efficient use of several crews of teams under lead hands, and communicate decisions and protocols up and down the chain of command
13. Coordinate with hatchery and processing plant for timing and scale of stocking and harvesting along with size of fish
14. Installation and maintenance of pens, nets, anchoring systems, and navigational aids
15. Purchase gear and equipment, or delegation of this task

HUMAN RESOURCES MANAGEMENT

Required:

1. Talent management, including hiring and firing decisions

2. Providing training to lead hands and farm hands
3. Compliance with employment law, including safety paperwork with compliance officer (e.g. insurance, culture)
4. Follow BAPs and maintain a positive attitude on the farm

Potential:

1. Manage worker schedules

KNOWLEDGE AND UNDERSTANDING

FINFISH CULTURE

Required:

1. Detailed fish and production biology
2. How to carry out and lead bigger tasks, as listed above

Suggested:

1. SCUBA certification

OPERATIONS MANAGEMENT

Required:

1. Basic production planning, including growth projections along with stocking and harvesting strategies
2. How to work with in sync with other departments of the business e.g. aligning hatchery timelines and production levels with grow-out planning to ensure they fit in with projected sales numbers and timelines
3. Best management practices for production and operations management, including farm design protocols and understanding logistics
4. Basic knowledge of mooring and cage systems
5. Basic knowledge of feeding and net cleaning systems

Suggested:

1. Detailed understanding of aquaculture, ocean science, biology, and production. Any sort of coursework and experience are helpful

HUMAN RESOURCES MANAGEMENT

Required:

1. Basic human resources course
2. Team building, including creating an environment in which crew members and chiefs are comfortable to admit mistakes and report issues
3. Talent recruitment and retention best practices
4. Conflict resolution and problem solving
5. How to maintain a positive attitude on the farm
6. Company culture, including how to train team members to be a good neighbor and company representative on the water

SEAWEED SUPPLEMENT

DUTIES

1. Ensure collection/quality of spore
2. Implement best practices for monitoring and growing seaweed, including layout, working with lead hand
3. Maintain relationship with buyer/processor
4. Ensure sale and pickup of product
5. Processing – if applicable
6. Recruit necessary labor and equipment for harvest
7. Provide proper training for labor, and ensure functionality of equipment

KNOWLEDGE AND UNDERSTANDING

1. Product development – if applicable
2. How to accurately manage finances of seaweed farm with other business i.e. fishing business
3. Regulatory compliance